

What Is Claimed Is:

- 1 1. An antenna for use in a wireless environment, said antenna comprising:
2 a plurality of antenna elements generating a beam; and
3 a lens collimating said beam in a desired direction such that said antenna can be
4 used to send and receive signals from a desired direction.

- 1 2. The antenna of claim 1, wherein said desired direction comprises a direction in
2 which a high density of wireless users are expected to be present in said wireless
3 environment.

- 1 3. The antenna of claim 2, wherein said direction is along a road.

- 1 4. The antenna of claim 1, comprising a plurality of lens including said lens,
2 wherein each of said plurality of lens is provided in a corresponding direction.

- 1 5. The antenna of claim 1, wherein said lens covers all of said antenna elements
2 and forms a radome.

- 1 6. A base station comprising:
2 an antenna containing a plurality of antenna elements and a lens, wherein said
3 plurality of antenna elements generate a beam and said lens collimates said beam in a
4 desired direction such that said base station can be used to send signals in said desired
5 direction.

1 7. The base station of claim 6, wherein said desired direction comprises a
2 direction in which a high density of wireless users are expected to be present.

1 8. The base station of claim 7, wherein said direction is along a road.

1 9. The base station of claim 6, comprising a plurality of lens including said lens,
2 wherein each of said plurality of lens is provided in a corresponding direction.

1 10. The base station of claim 6, further comprising:
2 a transmitter receiving a baseband signal and generating a broadband signal in a
3 frequency range suitable for transmission by said antenna; and
4 a divider receiving said broadband signal and generating an input signal for each
5 of said plurality of antenna elements.

1 11. The base station of claim 10, further comprising:
2 an attenuator and a phase shifter connected in series between said divider and one
3 of said plurality of antenna elements, said attenuator attenuating said input signal and said
4 phase shifter shifting a phase of said input signal.

1 12. The base station of claim 6, further comprising:
2 a summing block receiving a plurality of electrical signals from said antenna
3 elements and generating a broadband signal; and
4 a receiver block generating a baseband signal from said broadband signal.

1 13. A method of designing a lens located on top of a plurality of array elements in

2 an antenna, said antenna generating a desired collimation pattern for radiations generated
3 by said plurality of array elements, said method comprising:

4 determining a first radiation pattern of each of said plurality of array elements in
5 the absence of said lens;

6 determining a second radiation pattern of each of said plurality of array elements
7 based on said first radiation pattern, wherein said second radiation pattern is computed
8 with reference to a common origin for all of said plurality of array elements;

9 computing a composite radiation pattern (CRP) of said antenna based on said
10 second radiation pattern for each of said plurality of array elements;

11 characterizing said desired collimation pattern in the presence of said lens; and

12 determining a shape of said lens is determined from the characterized collimation
13 pattern and said CRP.

1 14. The method of claim 13, wherein said first radiation pattern and said second
2 radiation pattern are modeled according to a spherical modal approach, wherein said first
3 radiation pattern contains a first plurality of coefficients and said second radiation pattern
4 contains a second plurality of coefficients.

1 15. The method of claim 14, wherein said first plurality of coefficients are
2 determined by measuring a radiation at a radius R.

1 16. The method of claim 15, wherein said second plurality of coefficients are
2 determined by performing translation and rotation operations on said first radiation
3 pattern. /

1 17. The method of claim 16, wherein said shape of said lens is determined by
2 performing an inverse scattering operation using said CRP and said desired collimation
3 pattern.

1 18. A lens generated according to the method of claim 13.